Math 3C Fall 2014
Pre-lecture 5-2 Due: Beginning of lecture-Wednesday, November 5.

This is to be done on your own paper. Please write your name (last name first) on the top right corner along with your discussion section number (B02, B03 etc) and "pre-lecture [number]" (in this case "pre-lecture 5-2").

This will be graded on effort and thoughtfulness, not on correctness. With that said, do not feel obligated to write more than necessary. This is intended for you to work on your own.

This assignment will explore the properties of the logarithm function. What we do below works for $\log_b$ for any $b > 0$ where $b \neq 1$ but we will work in the special case $b = 3$.

1. Recall that $f(x) = \log_3(x)$ is the function such that

$$x = 3^{\log_3(x)}.$$

We will refer to this as the "key equation".

2. (Logarithm of a product)

   (a) Suppose that a and b are positive numbers. Apply the "key equation" to the number a (in other words, plug in $x = a$) to get "equation 1", to the number b (plug in $x = b$) to get "equation 2", and to the number ab (plug in $x = ab$) to get "equation 3"

   (b) Now multiply the left-hand sides and the right-hand sides of "equation 1" and "equation 2" together to get a new equation, we will call it "equation 4".

   (for example, if I had the equations $y = 5$ and $z = 6$ I could multiply the left-hand sides and right-hand sides of these equations to get $yz = 30$)

   (c) Now compare "equation 3" to "equation 4" (if you did it right, they should both be equal to the same thing).

   (d) Use an exponent rule (the one that says $3^c 3^d = 3^{c+d}$ for any numbers c and d) on "equation 4" to simplify the right-hand term. From this, what is another way to write $\log_3(ab)$?

   (e) Check this formula (from part d) for $a = 3$ and $b = 9$.

3. (Logarithm of a quotient)

   (a) Repeat the first two steps in part (a) from Question 2 to get "equation 1" and "equation 2". Also apply the "key equation" to the number $\frac{a}{b}$ to get "equation 3".

   (b) Now divide the left hand side of "equation 1" by the left-hand side of "equation 2" and the right-hand side of "equation 1" by the right-hand side of "equation 2" to get a new equation, we will call it "equation 4".

   (for example, if I had the equations $y = 5$ and $z = 6$, I could divide the first by the second to get $\frac{y}{z} = \frac{5}{6}$).

   (c) Now compare "equation 3" to "equation 4" (if you did it right, they should both be equal to the same thing)

   (d) Use an exponent rule (the one that says $\frac{3^c}{3^d} = 3^{c-d}$ for any numbers c and d) on "equation 4" to simplify the right-hand term. From this, what is another way to write $\log_3\left(\frac{a}{b}\right)$?

   (e) Check this formula (from part d) for $a = 9$ and $b = 3$.